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MEDALLISTS OF THE ROYAL SOCIETY¹

By Sir WILLIAM BRAGG

THE Copley Medal has been awarded to Professor Paul Langevin.

Professor Langevin was one of the band of young pioneers who, in the closing years of the last century, were engaged in exploring the field which had been opened up by J. J. Thomson's discovery of the electron. He spent a year (1897-1898) at the Cavendish Laboratory, and his Paris Dr ès Sc. thesis (1902) is dedicated to J. J. Thomson. The thesis, a notable one, was entitled "Recherches sur les Gaz Ionisés." It dealt mainly with the recombination and mobilities of ions, their coefficients and the relations between them. It is a standard work on this subject. In it he also devised and applied new and elegant methods of measuring these quantities, which were an advance on all their predecessors and have not since been im-

proved upon to any appreciable extent. Related to this, and coming later, were important contributions to the theory of the diffusion of gaseous ions and its relation to ionic mobilities.

Langevin's greatest achievement is the foundation of the electron theory of magnetism. The theories of paramagnetism and of diamagnetism are still very much as he made them and left them over thirty years ago.

There are few branches of contemporary physics which he has not illuminated and improved by his writings, and his work generally has the qualities of breadth, clearness, elegance and completeness which stamp the master.

He has had a great international influence. He has been a prominent figure at all the meetings of the conferences arranged by the Institut International de Physique Solvay since they started in 1911. On the

¹ From the address of the president at the anniversary meeting, November 30, 1940.

death of Lorentz he was chosen to succeed him as president of the Institut.

He was awarded the Hughes Medal in 1915 and elected a foreign member of the society in 1928.

The Rumford Medal is awarded to Professor Karl Manne Georg Siegbahn.

Professor Siegbahn, member of an old Swedish family, is, in the field of x-rays, what Rowland was in the field of ordinary optics sixty years ago. He has introduced high precision into x-ray measurements. For example, the most accurate wave-length measurements in 1913 were those of Moseley, with an accuracy of about 1 per cent. By a brilliant succession of improvements in methods, design, inventions and technique, Siegbahn by 1924 had improved this to 0.001 per cent., a factor of 1,000.

Siegbahn is not only a great physicist, he is also a great engineer. He has made inventions and improvements in almost every useful type of apparatus connected with x-ray measurements, pumps, gratings, x-ray tubes, ruling machines, etc.

Among his many achievements are the determination of the structure of the *L* series of x-ray spectra, the discovery of the anomalous dispersion of x-rays (with Hjalmar), the accurate and direct measurement of the grating spaces of calcite and rock salt, and the selection rules for the frequencies of x-ray absorption edges. In conjunction with Larsson and Waller he was the first to deviate x-rays with a prism. They developed this method till they could obtain by it measurements of refractive indices for x-rays which are of quite surprising accuracy.

In recent years he has been much occupied with the development and improvement of methods of measurement of "ultra-soft" x-rays, the region between about 10 to 500 Å, and with conspicuous success. This covers the gap between the ordinary x-ray region and the optical region of radiation.

He and his students have also been much interested in the values of the fundamental constants of physics and have made important contributions to our knowledge of them.

He has written a masterly book on the spectroscopy of x-rays. An extraordinarily large proportion of the information in it is due to the work of himself and his students. He has created an outstanding school at Uppsala and Stockholm, which now represents most of the physics of Sweden.

He was awarded the Hughes Medal in 1934.

A Royal Medal is awarded to Professor Patrick Maynard Stuart Blackett.

Professor Blackett is especially distinguished for his work on cosmic rays and the particles connected with them.

The early work which first brought his name into

prominence was concerned with the disintegration of nitrogen by α -particles; arising out of the experimental observations was the convincing proof that the disintegration process originated in the actual capture of the α -particle by the nitrogen nucleus.

The demonstration of cosmic-ray showers was one of Blackett's early successes with direct Wilson chamber photographs, but perhaps his most spectacular discovery—made simultaneously by Anderson in America—was that, in a large cloud chamber controlled by the tripping of counters, tracks appeared which could only be explained as due to a new particle—the positive electron. The importance of this discovery in the light of Dirac's theory was immediately realized by Blackett and his coworker Occhialini, and important results have emerged.

Blackett also—in collaboration with Chadwick and Occhialini—extended the work on the positive electron, and it was soon found that there were sources other than cosmic rays. With the same collaboration Blackett was also instrumental in showing that quanta of sufficient energy could produce a pair of electrons and this production was related to the so-called nuclear absorption of γ -rays—a phenomenon previously known but until then unexplained.

Blackett has followed up his cosmic-ray work and has published a number of very interesting papers dealing with various aspects of these rays. He has measured their energy, inferring therefrom a cosmic-ray energy spectrum; he has observed, with an extraordinarily high degree of accuracy, the scattering and energy loss of cosmic-ray particles in their passage through metal plates and has discussed the nature of the penetrating component of cosmic rays. Two papers on this topic appeared in the *Proceedings of the Royal Society* for 1938.

Lastly, reference must not be omitted of Blackett's important experimental contributions to our knowledge of the heavy electron—the particle which seems destined to be of such importance in the understanding of the more familiar nuclear particles.

A Royal Medal is awarded to Dr. Francis Hugh Adam Marshall.

Dr. Marshall's earlier research work (1903–1907) on the oestrous cycle, corpus luteum and removal and grafting of ovaries laid the foundations for all the modern discoveries concerning the internal secretions of the sex organs.

The publication of his large text-book on the "Physiology of Reproduction," in 1910, stimulated work on this subject throughout the world, not only on points of scientific interest but also in regard to the application to medicine and to questions of fertility and milk secretion in the domestic animals. He was engaged on a third edition of this book when war broke

out. He is generally acknowledged to be the father of this subject, and but few papers on this branch of science to-day are published without some reference to his work.

Arising out of his research, and that of his pupils, the importance of the anterior pituitary as a source of internal secretions, affecting not only the sex organs but also other body functions, has been recognized, and has led the way to an enormous volume of research work in recent years throughout the world. It is one of the subjects in which the greatest advances have been made in recent years.

Recently, his research has been concentrated on the exteroceptive factors, such as light, ultra-violet irradiation and nerve stimuli, which affect the sex organs by way of their effects on the anterior pituitary. This work explains the physiological basis for the seasonal and other changes which occur in reproductive activity. He summarized this aspect of the subject in the 1936 Croonian Lecture on "Sexual Periodicity and the Causes Which Determined It," beside adding new matter.

The Davy Medal is awarded to Professor Harold Clayton Urey.

Professor Urey's first important piece of work consisted in carrying out extensive, accurate, spectroscopic measurements on diatomic and polyatomic molecules. This led him in 1931 to take up a detailed investigation on the abundance of natural isotopes of hydrogen, nitrogen and oxygen. During the next few years he succeeded in isolating deuterium and calculating the comparative thermodynamic properties of deuterium, hydrodeuterium and hydrogen. In 1934 he accomplished the first synthesis of deuteromethane.

Deuterium or "labelled" hydrogen has proved of great value in investigating the mechanism of many organic and biologically important reactions and its use has been the precursor of the modern general isotopic exchange reactions. A number of deuterio derivatives have been prepared by Urey and his co-workers, and their entropies, vapor pressures and exchange equilibrium constants have been experimentally determined and compared with the theoretical values anticipated.

This isolation of deuterium from ordinary hydrogen and establishment of the thermodynamic, spectral and physico-chemical difference between it and pure hydrogen as well as in the compounds containing deuterium and hydrogen, is a remarkably complete piece of work, for which Urey received the Nobel Prize.

More recently Urey has taken up the problem of the separation of the other important, naturally occurring isotopes: those of nitrogen, oxygen and carbon. He has examined their quantity distribution in nature and employed exchange methods for the enrichment of one species.

The Darwin Medal is awarded to Professor James Peter Hill.

Over a long series of years Professor Hill has carried out researches on the development of various mammals, particularly as regards the embryonic membranes and placenta, and added greatly to our knowledge of this subject. Many of his conclusions have clear evolutionary implications, as for example that marsupials are descended from oviparous ancestors with meroblastic ova. In his Croonian Lecture of 1932, Professor Hill summarized his researches on the embryology and embryonic membranes of the Primates. The views of primate evolution based on development which he then put forward are in accord with those of Elliot Smith founded on brain anatomy, and of W. K. Gregory on morphological and paleontological evidence.

In collaboration with T. T. Flynn, Professor Hill has lately (1939) published the first part of extensive researches on the development of monotremes, both *Ornithorhynchus* and *Echidna*, which will be of great value in helping to assess the origin and relationships of these egg-laying mammals.

Professor Hill's research work is of first-class quality, being trustworthy and carried out with extreme care and the best techniques; it has never been scamped and is rich in original results over a wide field, most of the conclusions having a direct bearing on evolutionary questions.

Few living biologists have contributed more towards the solution of problems bearing on the interrelationships of the main groups of the Mammalia and on the phylogenetic history of the Primates, a subject with which Charles Darwin was so much concerned.

The Sylvester Medal is awarded to Professor Godfrey Harold Hardy.

G. H. Hardy is the author, or part author, of over 300 mathematical papers, two books and several of the Cambridge Mathematical Tracts.

Much of his work has been directed to the building up of the technique of modern mathematical analysis, and the simplicity with which the routine aspects of new work can now be presented is due very largely to fundamental results established by him.

It is characteristic of much of his work that it has stimulated others and has proved to be the starting point of important developments. His work in collaboration with J. E. Littlewood on Tauberian theorems is an example. From an isolated classical result a subject was created which to-day would require a treatise for its exposition.

His most outstanding contributions to the advance of mathematical knowledge have been in the theory of the Riemann zeta-function and the theory of numbers. The achievement of which, it is believed, he himself is most justly proud is the invention of the "circle

method." This is a technique of great beauty and generality which brings great refinement of mathematical analysis to bear on a wide class of unsolved problems in the theory of numbers. The method has been elaborated and improved by other mathematicians, but on its account alone the name of Hardy must for all time rank high among the masters of his subject.

No appreciation of the services of Hardy to the advance of mathematics would be complete which did not attempt to assess the value of his personal influence. Throughout his career he has been the driving force behind a vigorous group of younger research workers. A very considerable proportion of the pure mathematical research now being published in this country is traceable more or less directly to his interest and encouragement, or to the inspiration of his earlier work. His unstinted service during many years to the detailed work of the London Mathematical Society, and the freedom with which his experience and advice are available to all, have established him in a unique position in the regard of British mathematicians.

The Hughes Medal is awarded to Professor Arthur Holly Compton.

Professor Compton has made a number of important contributions to physical science in the field of x-rays and elsewhere. Of late years he has been one of the leaders in the study of cosmic rays.

The experiments of Young and Fresnel early in the nineteenth century proved that light certainly had undulatory properties. But in the present century facts have been emerging, notably in connection with photoelectric action, which are impossible to reconcile with the assumption that light can be described only as an electromagnetic wave of the classical type. These dif-

ficulties disappeared if light of frequency ν is assumed to be dynamically equivalent to a collection of particles of energy $h\nu$ (h = Planck's constant).

It occurred to Compton that from this standpoint the interaction between radiation and free electrons is very simple, and in fact is the simplest interaction which radiation can undergo. Associated with the energy $h\nu$, according to the electromagnetic theory, there is momentum $h\nu/c$ (c = velocity of light). The interaction is thus reduced to a very ancient problem, that of the encounter of two infinitesimal billiard balls with known energies and momenta. As the radiation moves with the velocity of light, in most cases the electron can be treated as if it were at rest. It is then obvious that in the collision the electron will acquire energy from the radiation and the conservation of momentum requires that if the electron moves off in a certain direction the radiation will travel in a certain other direction. But reduction of energy of a quantum of radiation means increase in wave-length, and this increase will be a predetermined function of the direction of the "scattered" radiation and of the direction of motion of the "recoil" electron.

He published these conclusions in 1922. In 1923 he established the change in wave-length, first qualitatively by Barkla's absorption coefficient methods and then quantitatively with the x-ray spectrometer. In the succeeding years he investigated the energies of the recoil electrons as a function of their direction of motion and showed that the correlation, predicted by the theory, between the direction and energy of the recoil electrons on the one hand and the direction and change of wave-length of the radiation on the other did in fact occur. This correlation is of fundamental importance in the general theory of the interaction of radiation with matter.

EACH AFTER HIS KIND¹

By Dr. LEON J. COLE

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PRACTICAL CONSIDERATIONS

LONG after the binomial system was well established, collections of animals and plants were relatively small and attention was centered on the general type of species rather than on the intergradations between them. As larger series of specimens were studied intensively and critically the tendency naturally was to apply additional specific names to recognizable intermediate groups, until the series became so complete as to be

practically continuous. At that stage the whole series might be thrown together again under a single species name, with the various component groups ranked under it as subspecies. Such shifts seem inevitable if nomenclature and classification are to keep up with increasing knowledge, but the consequent instability and constant change have been a perpetual source of annoyance to those biologists who are more concerned with the anatomy, physiology or embryology of a species than with what it is called. The multiplication of species seems to have been particularly irritating and led Cowles to exclaim:¹⁴ "One of the noblest aims of

¹ Concluding part of the address of the retiring vice-president and chairman of the Section for the Zoological Sciences of the American Association for the Advancement of Science, Philadelphia, December 31, 1940.

¹⁴ *Amer. Nat.*, 42: 266, 1908.

ecology is the destruction of many of the 'species' of our manuals." The general impression among this class of biologists has been that taxonomists consist of two groups, the "splitters" and the "lumpers," and that the current manuals and monographs reflect the changing vicissitudes of the struggle that goes on between them. There has been protest particularly against the changing of long-used and widely known generic names. It is a trifle disconcerting, it must be admitted, for the casual student of birds to find that our common American robin, which started out as *Turdus migratorius*, and which he perhaps learned, if he is about my age, as *Merula migratoria*, and which later became *Planesticus migratorius*, is now back where it started at *Turdus*. The only things that have remained constant about it are the specific name *migratorius* and the common name, robin—but it should be noted that it was one given another specific name, *canadensis*, and that so far as the common name is concerned, the bird never was properly a robin in the first place! The laboratory worker and teacher is equally disturbed when he meets such an old friend as *Amphioxus* parading as *Branchiostoma*, though he may be inclined to agree to the appropriateness when *Amoeba* becomes *Chaos*!

In 1897 Merriam published a paper entitled "Suggestions for a New Method of Discriminating between Species and Subspecies,"¹⁵ which embodied the idea already discussed of including in a species those groups which form a continuous series. The following year Davenport and Blankinship¹⁶ made what was presumably the first attempt to put these distinctions on a purely objective basis. They suggested that since "confluent species are usually separated chiefly by one most distinctive character," this "chief differential" should be carefully measured (or counted if the character differed in discrete units) in the several populations, and the results plotted as a frequency distribution. If the resulting curve was evenly unimodal the whole array was interpreted as a single, uniformly varying species. Two or more modes were to be interpreted as indicating as many species or subspecies, the distinction depending on the distance between the modes and the depth of the valleys separating them. For this purpose they proposed an *Index of Isolation*—the depth of the depression between two maxima (modes), expressed in per cent. of the length of the shorter mode; and an *Index of Divergence*—"the distance between modes, expressed as the ratio of the distance between the modes of the half-range, or thrice the standard deviation of the broader curve." While these definitions and the method do not appear to have been adopted in detail, the general conception, blended with judgment, has been very useful in cases where

good quantitative or numerical characters are available, as in the number of fin rays or lateral line scales in fishes. Ginsburg¹⁷ has recently resurrected what is basically the proposal of Davenport and Blankinship, but has carried it to further degrees of refinement in order to differentiate groups below the order of subspecies. He proposes, however, to use only binomial names (which will be applauded by many) and to use a numeral subscript to indicate the relation of any sub-group to the species as a whole. Like Davenport and Blankinship, he bases his classification on a single "principal character." The general scheme will undoubtedly prove useful in some groups, but it is doubtful that the designation of the species and sub-groups by such arbitrary means will have widespread acceptance.

Edgar Anderson¹⁸ has suggested an arithmetic method of evaluating species hybrids, which he and Ownbey¹⁹ later extended for the determination of genetic coefficients to be used for: "(1) The efficient measurement of specific and subspecific divergence; (2) The genetic analysis of differences between species; (3) The determination of phylogenetic patterns." These authors are skeptical of the use of strictly quantitative characters and prefer to measure the similarity or difference with respect to the expression of a considerable number of qualitative characters in the forms being compared. The method loses considerable of its seeming exactness, however, since it is admitted that the characters chosen differ in importance, and judgment again enters in rating their relative value.

From what has preceded it will be seen that thus far attempts to stabilize taxonomy, and hence nomenclature, have by no means been altogether successful for reasons which have been pointed out. Numerous proposals have been made to cut the Gordian knot and separate the naming of species from the implications of relationship. Needham²⁰ long since proposed that only broad generic names should be used and that species in the genus should be known by numbers which would be applied in the order of their description. Certain supplementary signs would give additional information as to types and synonymy. This shorthand method not finding favor, Needham twenty years later,²¹ apparently in despair, cried: "Let the existing system stand for the systematists. Let it grow and flourish. Let the splitters have their revel. The *mihi* itch is such a delightful disease, I would by no means deprive my worthy systematic colleagues of the

¹⁷ *Copeia*, 3, 1937; *Zoologica*, 23: 253-286, 1938; *Jour. Wash. Acad. Sci.*, 29: 317-330, 1939; *Zoologica*, 25: 15-31, 1940.

¹⁸ *Ann. Missouri Bot. Garden*, 25: 511-525, 1936.

¹⁹ *Ibid.*, 26: 325-348, 1939.

²⁰ *SCIENCE*, n.s. 32: 295-300, 1910.

²¹ *Ibid.*, n.s. 71: 26-28, 1930.

¹⁵ *SCIENCE*, n.s. 5: 753-758, 1897.

¹⁶ *Ibid.*, n.s. 7: 685-695, 1898.

pleasure they find in scratching. But let us have simpler names for common use."

Another attempt at a shorthand designation of species has recently been put forward by Rabel.²² Maintaining that, as Needham says, "A name is a name and not a treatise on relationships," she would go the whole way and have the name represented by a number built on a scheme like an artificial key. She would: "Let then the students of phylogenies indulge as they please in their own private theories, let their conjectures fluctuate from year to year, from man to man, they would simply announce that according to their opinion the animals 7139275 . . . and 7132908 . . . are of common descent." I can imagine a modern Audubon's field notes reading something as follows: "Observed a 9657051 dive and catch a 476408; it was in turn pursued by a 9676275, which forced it to drop its prey; this the 9676275 then carried to the stub of a 2626519 and proceeded to devour"—innocently unmindful, I may add, of the indigestion such a meal might engender. Of course, the scheme has the advantage that it might be handled by the punch card system—and would be about as readable as a punch card held to the light.

The foregoing discussion has concerned largely the taxonomic problems in the higher animals and to some extent in plants. As Darlington says:²³ "We feel that we ought to have a 'species concept,'" but, he adds: "In fact, there can be no species concept based on the species of descriptive convenience that will not ensnare its own author so soon as he steps outside the group from which he made the concept." The truth of this is apparent when one considers the special problems in the lower invertebrates, and in fungi, particularly the imperfecti and bacteria. In these, morphological characters are commonly indefinite or lacking, and the situation is further complicated by complex life cycles and various methods of reproduction. As a consequence species are separated largely on the basis of physiological response, which usually can be determined only by extensive controlled cultural experiments, and the same is true of reproductive cycles. Hadley²⁴ has recently advanced the view that "the bacterial individuum should not be conceived of as a single cell but as a minute plant organism, the bacterial species-microphyte," and that species distinctions must be based on all stages of dissociative variation. Carrying the matter further, Darlington²⁵ has suggested that, "In the virus the definition of a species is clearly a matter of molecular structure,"—if so the virus taxonomist will either have to be also a physicist or have one at his elbow.

²² *Discovery* (Cambr. Univ. Press), n.s. 3: 16-24, 1940.

²³ "The New Systematics," 1940, p. 159.

²⁴ *Jour. Infect. Dis.*, 65: 267-272, 1939.

²⁵ "The New Systematics," p. 158, 1940.

CONCLUSIONS

In conclusion, we may do well to consider the "new" systematics in relation to the "old." The older viewpoint looked upon systematics as essentially static, or at any rate the taxonomist tried to make it so. The wail of his non-taxonomic colleagues was that he stirred things up so much in the process, and that he did not succeed in his worthy objective of "stabilizing" nomenclature. According to the modern view the reason it can not be stabilized is that it deals with a changing, dynamic process of many currents. There are many kinds of isolating mechanisms and many degrees and kinds of group sterility; consequently there are different sorts of species, as well as of other groups. This means that in order to discover true relationship and phylogenies, as well as the *modus* of speciation, exhaustive investigation must be made of all phases of organisms, including, in addition to their more obvious characters, their range and ecological adaptations, their variability, breeding behavior, chromosome structure and anything else that will serve to characterize them in all stages of their life cycle.

But in our enthusiasm over this exciting new game let us not forget our faithful taxonomic colleagues who are still diligently catching all kinds of animals and sorting and penning them in nomenclatorial cages for us until we can get around to the more intensive study. In the meantime we should accept gratefully what they can give us. For how can they plot curves of variability on some new deep-sea fish, of which perhaps a half dozen specimens have been taken in a century, in order to determine its index of divergence? And how can they determine its relationship to other species by hybridization methods, since it is invariably dead when it reaches the surface? By what means can its chromosomes be observed and their behavior studied? Because these things can not be done, should these specimens be put away in pickle and go nameless, or will greater service be rendered by naming them and assigning them a place in the classification as accurately as judgment will allow? If some change has to be made later as a result of further information, that is scarcely to be avoided. But, as many have pointed out, this is a job for experts, and even they should bear in mind that terminology has a use besides that of expressing the latest individual ideas as to systematic arrangement.

As a help towards the stabilization of names, it has been suggested that strictly binomial terminology—that is, only the names of the genus and species—should be employed for all general purposes. Accordingly the genus should be kept of rather broad definition. Genus splitting seems often to be carried to the extreme of absurdity; for example, consider the case cited by Stone of three East Indian cuckoos which are

classed in three separate genera on the basis of differences in the position of the nasal opening, in spite of the fact that "their coloration is so exactly similar that they are with difficulty distinguished in the hand without examining the bill."²⁶

There would appear to be a similar advantage in putting as broad an interpretation as possible also on the species, in accordance with the general principles which have been stated. Then for purposes of reference in general use it would not matter so much about changes and rearrangements in other groups. As species became more thoroughly analyzed they would naturally be split into subspecies, which might in turn be divided still further. Let these be carefully described, and if naming will serve any useful purpose, let them receive quadriminials and quinquenominials, even to the ecotypes and ecads, and to genotypes and karyotypes and cytotypes; yes, even to individuals when necessary. But in general as the divisions are smaller the process of change will be greater, and any grouping is likely to be transitory. We should be careful, therefore, that these micro-groups should not acquire the sanctity that seems to attach to the species. Accuracy and intelligibility should be sought rather than priority.

It has also been suggested that the International Commissions on Nomenclature in both zoology and botany could help more towards stabilization if they were accorded somewhat broader as well as more arbitrary powers to deal with cases that come before them. Certainly there is danger that the rules of nomenclature, like any other legal code, will become inflexible and outmoded unless provision is made for change.

Classical taxonomy should on the whole exert a conservative force, but it must nevertheless take cognizance of the advances in knowledge in order to keep abreast of the times.

Appeasement is not popular at the moment, yet I would bespeak an attempt at greater mutual understanding and certainly of tolerance. Much of the heat that has been engendered between and among taxonomists and other biologists has been due to the failure of each to understand the problems of the other. I will not presume to make any prediction of my own, but you may be interested, whether you agree with it or not, in a recent prophecy by Julian Huxley.²⁷ After saying that micro-evolutionary studies (that is, those dealing with small groups) will become increasingly important in the near future, he concludes as follows:

As such work proceeds, the New Systematics will gradually come into being. It will in some ways doubtless help classical taxonomy in its practical pigeon-holing functions; it will give a more detailed picture of the actual facts of the diversity of organic nature and its distribution in groups and in character-gradients over the globe; it will reveal many facts and principles of great importance to general biology; and through it taxonomy will become the field of major interest for all those concerned with the study of evolution at work.

As for myself, I am uncertain whether to interpret this last prediction to mean that in that time the taxonomic lion and the genetics lamb will lie down peacefully together, or whether the latter will have turned carnivorous and have devoured his ancient and honorable companion.

OBITUARY

DAYTON C. MILLER AND THE POPULARIZATION OF SCIENCE¹

ANY record of the accomplishments of the late Dr. Dayton C. Miller, the distinguished American scientist and teacher who died on February 22, would be incomplete without mention of his services in the popularization of science. A skilled worker in the research laboratory and a wise teacher in the classroom, he had broad enough vision to see beyond laboratory and classroom. A deep and sympathetic understanding of humanity impelled him to lend his influence and energies to this end.

In company with some of the greatest figures in the history of science, he possessed the gift of making science clear to laymen and to young people. In this he was one with the great Faraday, with Huxley, with Sir

Oliver Lodge and with Sir William Bragg. It is interesting to note that one of the last major activities of his life was a series of children's lectures delivered at Christmas time at the Franklin Institute in Philadelphia in 1937 and expanded into a book two years later under the title of "Sparks, Lightning, Cosmic Rays."

With the reader's permission, I would like to draw upon my own experiences to illustrate Dr. Miller's efforts for the popularization of science.

I saw Dr. Miller for the first time at one of his young people's lectures. The year was 1913 and I was then a junior at Central High School in Cleveland. Our scientific club, named the Faraday Club, had been invited to the Physics Laboratory of Case School of Applied Science to hear Dr. Miller lecture on sound waves.

Had Professor Miller been lecturing to his colleagues in the National Academy of Sciences, he could

²⁷ "The New Systematics," 1939, p. 42.

²⁶ *Jour. Acad. Nat. Sci. Phila.*, 15: 314, 1912.

¹ An obituary appreciation of Dr. Miller, by Professor H. W. Mountcastle, of the Case School of Applied Science, was printed in the issue of SCIENCE for March 21.

not have made more elaborate preparations than he did for the enlightenment of our half a hundred high-school boys and girls. He not only used stereopticon slides to illustrate his lecture but performed more than a dozen experiments for us upon the table at the front of the lecture room. The lecture concluded with a demonstration of the phonodeik, the device which he had invented to make sound waves visible.

I still remember the delightful enthusiasm with which Dr. Miller spoke to our group of students and the enthusiasm for science which we brought away from that lecture.

In 1915 I entered Western Reserve University in Cleveland and obtained the job of college correspondent for *The Cleveland Press*. My duties were to "cover" football games and other athletic events and otherwise report campus activities at both Western Reserve and Case School of Applied Science. As many readers of *SCIENCE* know, only a fence separates the campuses of the two schools.

Almost at once I began to hear of the remarkable experiments with sound waves which Dr. Miller, then professor of physics and director of the Physics Laboratory, was performing at Case. Remembering the inspiring lecture I had heard two years before, I decided to call upon him.

And so, holding in my hand the green cap that the Reserve freshmen of that day were required to wear, I climbed the stairs of the Physics Building on the Case campus and knocked on Dr. Miller's door.

Had I been a visiting professor from some great European university, I could not have been received more graciously. Dr. Miller listened sympathetically while I explained who I was, the vivid impression I retained of the lecture I had heard, my own enthusiasm for science, and finally my desire to write an article about his work.

Dr. Miller agreed to show me through his laboratory and under his personal guidance I was introduced to the enchanted land in which he was unraveling some of the secrets of nature. I did not then realize that Dr. Miller was doing a courageous thing in entrusting his scientific reputation to the mercies of a college freshman, particularly in view of the fact that back in 1915 most scientists feared newspaper mention.

My article appeared in the next day's *Cleveland Press*. It was, of course, my first newspaper article on science. That first meeting marked the beginning of a friendship that lasted until Dr. Miller's death. I became a frequent visitor at his laboratory, and his encouragement had much to do with my decision to devote myself to the popularization of science.

In December, 1922, at the suggestion of Dr. Miller, I attended the Boston meeting of the American Asso-

ciation for the Advancement of Science. That meeting was the first one to be reported in a serious and thorough fashion with a genuine effort to interpret its importance to the public. Present at it were the late Dr. E. E. Slosson and Watson Davis, representing Science Service, Alva Johnston, representing the *New York Times*, and myself, representing the Scripps-Howard Newspapers.

The following April, again at Dr. Miller's suggestion, I attended the spring meetings of the American Philosophical Society and the National Academy of Sciences. I have missed only three or four of the meetings of these three organizations since.

Dr. Miller was a sympathetic and helpful friend to the science writers of the nation from 1922 until his death. He was well known to all of them and always ready to befriend them.

The last public affair at which Dr. Miller appeared was a "Star Gazers Dinner" given by the *Cleveland Press* on January 24, 1941. In the summer of 1939 and again in the summer of 1940, I had arranged with the amateur astronomers of the Cleveland Astronomical Society, for a series of "star-gazing parties" in Cleveland parks. More than a dozen telescopes were set up on a given night in a particular park and the citizens of Cleveland invited to come and have a look. About 15,000 people took advantage of these invitations each summer.

Dr. Miller showed his interest in these affairs by coming to several of the "parties" to observe the crowds and so when the *Cleveland Press* decided to give a dinner on January 24 for the amateur astronomers who had so generously supplied and operated the telescopes, I asked Dr. Miller to be one of the speakers.

A number of our telescopes had been operated by college students and even high-school students and characteristically Dr. Miller thought chiefly of these in preparing his remarks. He brought to the dinner an old notebook in which he had made sketches of comets and other phenomena when he himself had been an undergraduate at college. He exhibited this notebook with the hopes that the young people present might be inspired to keep similar sketches of their observations and spoke with enthusiasm of the success of the "star-gazing parties" in spreading a knowledge of popular science.

The last time I saw Dr. Miller was at the close of the dinner. The young people had crowded around him with enthusiasm for a closer look at his drawings. Their enthusiasm was reflected in his own friendly smile. I like to remember Dayton C. Miller that way.

DAVID DIETZ,

Science editor, Scripps-Howard Newspapers

RECENT DEATHS

DR. FREDERIC WILLIAM SIMONDS, who retired as professor of geology at the University of Texas in 1936, died on March 26 at the age of eighty-seven years. He joined the faculty of the university as associate professor in 1890.

DR. WAYNE J. ATWELL, professor of anatomy and head of the department at the University of Buffalo, died on March 27 in his fifty-second year.

NATHAN RICHARD GEORGE, professor emeritus of mathematics of the Massachusetts Institute of Technology, died on March 26 in his seventy-sixth year. He had been associated with the institute since 1891, when he was appointed an instructor in mathematics.

DR. J. R. BAILEY, professor of organic chemistry at the University of Texas, died on March 25, in his seventy-second year.

SCIENTIFIC EVENTS

GIFT TO THE ROYAL SOCIETY BY THE AMERICAN PHILOSOPHICAL SOCIETY

OWING to the fact that scientific societies in Great Britain are now finding it difficult to publish the results of researches which have been carried on by their members, the American Philosophical Society, through its Committees on Publications and Finance, authorized the setting aside of \$10,000 from its budget for the aid of science and learning in Great Britain, and the president of the society inquired of the British Embassy whether the Royal Society of London would accept a gift to be used in aid of science and learning in Great Britain. Word was received through the office of the Consul General of Philadelphia that the Royal Society of London would gratefully accept the generous gift of the American Philosophical Society. Accordingly, the society cabled \$10,000 to the Royal Society and a letter was forwarded by air mail expressing the hope that they would use this sum where it might be of most service in aid of science and learning in Britain and closing with these words: "We make this gift in filial regard for the Royal Society which was the model upon which Benjamin Franklin in 1743 founded the American Philosophical Society for Promoting Useful Knowledge Among the British Plantations in America and as evidence of the spirit of friendship and good will among men of science in both countries." A radiogram has been received from the Royal Society saying: "Deeply appreciate good will shown by your generous gift. It can be well used."

An official announcement given out by the society reads:

In further explanation it should be said that the "Royal Society of London for Improving Natural Knowledge" was chartered in 1662 and is one of the oldest and most distinguished learned societies in the world; its membership being limited to scientists of great distinction. In its distinguished membership, its form of organization and its scientific activities the American Philosophical Society closely follows the Royal Society. Perhaps in the substitution of the word "useful" in the title of the American Philosophical Society for "natural" in the title of

the Royal Society we have a reflection of Franklin's practical nature, but in reality the Philosophical Society has always regarded all knowledge as useful.

Franklin himself was a member of the Royal Society as were many other members of the American Philosophical Society and the list of foreign members of the latter has always included a large number of the Fellows of the Royal Society.

This gift from the oldest learned Society of America to the oldest in Great Britain is inspired not only by filial regard, but also as evidence of the internationalism of science and scientists and their determination that the advancement of knowledge must not be stopped even by war.

TRAINING PHYSICIANS FOR GREAT BRITAIN¹

JUST before he died, Lord Lothian, British Ambassador to the United States, asked the Rockefeller Foundation whether it would consider the possibility of giving a number of British medical students the opportunity to complete their training in the medical schools of the United States and Canada. While medical students in England are not subject to draft, the air raids in London and elsewhere throughout Great Britain have imposed excessive demands upon all medical schools and teaching hospitals. Destruction has been extensive. In London, at this writing, only one teaching hospital has escaped bombing. The conditions for thorough and adequate teaching in medicine are therefore severely deranged. A considerable number of the teachers, moreover, have been called to military or special civilian duties, and, together with the profession as a whole, are exposed to injury and death in a measure that heightens the importance of adequate training for those who will be their successors. A break in the chain of medical teaching in any country spells disaster for the next generation.

Lord Lothian's suggestion was warmly supported by leading British medical authorities, and as a result the foundation appropriated \$100,000 to initiate the plan. This proposed cooperation between British and American medical schools is the fruit of earlier and very

¹ From the review for 1940 of Dr. Raymond B. Fosdick, president of the Rockefeller Foundation.

satisfactory relationships. For seventeen years the foundation has provided fellowship funds to the British Medical Research Council for the training of British postdoctoral medical students in America. These fellows have been of exceptional quality. Upon their return to the British Isles they have carried with them a favorable impression of the American experience. As a result, American medical education is held in esteem by many of the younger leaders in British medicine. This new project is launched, therefore, in an atmosphere of mutual respect and confidence.

Twenty-five leading medical schools in Canada and the United States have indicated their cordial willingness to accept these new students, and some have offered to remit tuition. An officer of the foundation is now in England working with a British committee on the details of selection and transportation. Candidates will be considered not only from the London area but from the provincial universities in England, Scotland and Wales, where extensive damage has also been done to clinical teaching services. Arrangements are being made for the local supervision of the students in America and for the acceptance by British medical authorities of their American training, when successfully completed, as the equivalent of the British licensure. Appointments will be for not more than three years and will provide modest living expenses and tuition. The three-year period is likely to include two years of clinical training and one year of internship. The student will be expected to provide his own cost of travel. He will, of course, be required to return to Great Britain upon the termination of his scholarship. The scholarship will be administered by the authorities of the school to which he is assigned, and it is not expected that he will be enrolled as a candidate for an American degree.

Unless unforeseen difficulties occur, it is anticipated that some of the students will arrive in America this spring, and the balance by the opening of the fall term. The foundation intends to consider a possible extension of the plan if the first year's experience is successful.

RESEARCH LABORATORY OF THE STANDARD OIL COMPANY

AN important forward step in the cooperation between industry and educational institutions will be taken with the construction of a research laboratory by the Standard Oil Company of Ohio. The new laboratory will be built on land purchased from Western Reserve University and coordinated with the university. It will be a two-story brick structure of modern design, with approximately 14,000 square feet of floor space, exclusive of its utility building; it will occupy a frontage of 200 feet on Cornell Road adjoining the Belt Line tracks.

The building, which will be completely fireproof

and which will incorporate many safety features, will house the research activities of the Standard Oil Company, which for the past twelve years have been conducted in coordination with Western Reserve University.

The research program began in 1928 under the direction of Dr. Robert E. Burk, who is still in charge. He graduated from Cornell University in 1922, received his M.A. degree from Harvard in 1923, and his Ph.D. degree at the University of Oxford, where he was a Rhodes scholar.

The research laboratories, which now occupy quarters in the power building of the university, employ a staff of twenty-one people. In addition to the existing laboratories, a specialized library will be incorporated in the building, supplementing the extensive library which have been built up by the university over a period of more than a century.

"The interest of the Standard Oil Company in maintaining a research laboratory," according to G. W. Hanneken, vice-president in charge of refineries, is accounted for by the fact that the applications of science, particularly of chemistry, have grown enormously in the petroleum industry in the last ten years, particularly the last five years. Gasoline is now 'tailor-made' through the cooperation of the synthetic chemist with the engineer. The university, with its facilities for systematic and continued instruction of the research staff, provides the means for keeping the staff informed in newly developed scientific fields—an essential factor in an undertaking of this type.

Ground will be broken for the new laboratory in the near future.

THE AMERICAN MUSEUM OF HEALTH

SEVENTY outstanding authorities in medicine and public health have accepted the invitation of the American Museum of Health to serve on its newly created Scientific Advisory Board. Dr. Haven Emerson, formerly health commissioner of New York City, has been named chairman.

The formation of this advisory group will "assure the continuing scientific integrity of the exhibits presented in the museum," it was stated by Dr. Louis J. Dublin, chairman of the Board of Directors. The museum built and operated the exhibits in the Medicine and Public Health Building at the New York World's Fair, which were seen by 11,500,000 persons. It plans to open its permanent exhibition in Flushing Meadow Park early next summer after reconstruction of its new quarters in the former Masterpieces of Art Building on the old fair site has been completed.

In addition to Dr. Emerson the Scientific Advisory Board is comprised of the following members:

Dr. W. W. Bauer, Dr. Conrad Berens, Dr. Ernst Boas, Dr. Karl M. Bowman, Dr. Leverett D. Bristol, Dr.

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Cameron, Dr. Walter B. Cannon, Dr. Anton J. Carlson, Dr. McKeen Cattell, Dr. Russell L. Cecil, Dr. A. E. Cohn, Dr. E. H. L. Corwin, Dr. Waite A. Cotton, Miss Dorothy Manning, Dr. Robert L. Dickinson, John Dorr, Dr. George E. Dyer, Dr. Rolla E. Dyer, Dr. Martha Eliot, Dr. Kendall Emerson, Dr. Maxwell Finland, Dr. Morris Fishbein, Dr. Thomas Francis, Jr., Leslie Frank, Dr. Robert T. Frank, Dr. Walter S. Frisbie, Dr. John F. Fulton, Dr. Edward S. Jeffrey, Jr., Dr. S. S. Goldwater, Dr. Leonard Greenburg, Dr. W. K. Gregory, Dr. Howard W. Haggard, Dr. John Hardenbergh, Dr. Charles G. Heyd, Dr. I. Seth Hirsch, Dr. Elliott P. Joslin, Dr. H. E. Kleinschmidt, Dr. George Kosmak, Dr. A. J. Lanza, Dr. Alfred J. Lotka, Dr. T. Archibald Malloch, Dr. Harvey B. Matthews, Dr. Leo Mayer, Arthur Miller, Dr. J. A. Miller, Dr. John R. Mohler, Dr. Ralph Muckenfuss, Dr. C. W. Munger, Dr. J. Opie McCall, Frederick Osborn, Dr. Francis M. Rackemann, Dr. W. C. Rappleye, Dr. Paul Reznikoff, Dr. Corneilius P. Rhoads, Dr. Thomas M. Rivers, Dr. Milton J. Rosenau, Dr. George Ruhland, Dr. James R. Scott, Dr. Henry C. Sherman, Professor J. M. Sherman, Dr. Henry Sigerist, Dr. W. G. Smillie, Dr. W. F. Snow, Dr. Wm. Tillett, Dr. Philip Van Ingen, Dr. Augustus B. Wadsworth, Dr. W. Frank Walker, Dr. George B. Wallace, Dr. E. A. Winslow, Dr. Abel Wolman.

THE TWENTIETH ANNIVERSARY OF THE DIVISION OF PETROLEUM CHEMISTRY OF THE AMERICAN CHEMICAL SOCIETY

THE Division of Petroleum Chemistry of the American Chemical Society will celebrate its twentieth anniversary by sponsoring a two-day symposium on "Analytical Methods Used in the Petroleum Industry" at the one hundred and first national meeting of the society to be held from April 7 to 11 in St. Louis.

Nineteen research reports by technologists from all parts of the country will be presented at the symposium, at which J. K. Roberts, of Chicago, research director of the Standard Oil Company of Indiana and chairman of the division, will preside. New designs for a fractionating column, an instrument to measure the viscosity of opaque liquids and a filtration cylinder will be described, together with modifications of accepted analytical techniques.

The application of chemical methods to exploration for petroleum will be discussed at a general meeting, which includes a program of ten papers. An anniversary dinner will be held by the division on the evening of April 8.

The division, of which Cary R. Wagner, chief chemist of the Pure Oil Company, Chicago, is secretary, was organized with thirty charter members in April, 1921, during a national meeting of the society at Rochester, N. Y. The first chairman was Dr. Thomas G. Delbridge, of the Atlantic Refining Company, Philadelphia.

The division now has nearly 700 members and since

1928 has sponsored seven national symposia on the problems and contributions of petroleum chemistry. With the American Petroleum Institute Committee on Hydrocarbon Research, the division maintains a "hydrocarbon bank" of pure hydrocarbons available for research, conducted by Professor C. E. Boord, of the Ohio State University.

A detailed account of the history of the division is given in the *News Edition* of the American Chemical Society.

THE CHICAGO MEETING OF THE FEDERATION OF AMERICAN SOCIETIES FOR EXPERIMENTAL BIOLOGY

THE Federation of American Societies for Experimental Biology, under the presidency of Dr. Andrew C. Ivy, professor and chairman of the department of physiology at Northwestern University, will meet at the University of Chicago from April 16 to 19.

The five scientific societies composing the federation will participate in the meeting. They are the American Physiological Society, of which Dr. Ivy is also president; the American Society of Biological Chemists, presided over by Dr. William C. Rose, professor of biochemistry at the University of Illinois; the American Society of Pharmacology and Experimental Therapeutics, presided over by Dr. Eugene M. K. Geiling, professor and chairman of the department of pharmacology at the University of Chicago; the American Society for Experimental Pathology, presided over by Dr. Shields Warren, assistant professor of pathology at Harvard University Medical School, and the American Institute of Nutrition, of which Dr. Thorne M. Carpenter, director of the nutrition laboratory of the Carnegie Institution in Boston, is president.

The Stevens Hotel on the Lake Front will serve as headquarters. Garage and open air parking places at moderate prices can be found within one block of the hotel. All scientific sessions and demonstrations, including the Joint Session of the federation and the Annual Smoker and Dinner, will be held at the hotel.

The Institute of Nutrition will hold its scientific sessions on Wednesday, April 16. The Joint Session of the Federation will be held on Thursday morning, April 17, after which the constituent societies will hold scientific sessions. On Thursday evening at nine o'clock the local committee will provide an informal smoker. The annual dinner will be held on Friday evening at seven o'clock.

In conjunction with the meeting of the federation, the American Association for Cancer Research will meet from April 15 to 16, and the American Association of Immunologists, from April 16 to 17. Dr. Burton T. Simpson, associate professor of pathology at the University of Buffalo, will preside over the

meetings of the American Association for Cancer Research, and Dr. Karl F. Meyer, professor and chairman of the department of bacteriology at the University of California, is president of the American Association of Immunologists. The American Association

of Anatomists also will hold its fifty-seventh annual meeting at Chicago on April 9, 10 and 11, under the presidency of Dr. Philip E. Smith, professor of anatomy at the College of Physicians and Surgeons of Columbia University.

SCIENTIFIC NOTES AND NEWS

THE doctorate of science will be conferred by the University of Wisconsin at its eighty-eighth commencement on June 23 on Dr. Herbert S. Gasser, director of the Rockefeller Institute for Medical Research.

THE Howard Crosby Warren Medal for "distinguished research" during the past five years, awarded by the Society of Experimental Psychologists, was presented at Rutgers University on March 28 to Dr. Clarence H. Graham, associate professor of psychology at Brown University, in recognition of his work in the psychology of vision. The medal was presented by Professor Carroll C. Pratt, of Rutgers University, chairman of the society.

IN recognition of "the outstanding service" rendered by Dr. William J. Gies, professor emeritus of biochemistry at Columbia University, he has been made a life member of the council of the International Association for Dental Research.

THE Society of Medical Officers of Health, London, gave a luncheon on February 21 in honor of Surgeon-General Thomas Parran, head of the United States Public Health Service, Dr. F. T. H. Wood, the president, being in the chair. The Lord Mayor of London, medical officers of health and representatives of local authorities and of the Ministry of Health attended the luncheon. Dr. George Buchan, who took the chair after the luncheon, proposed the health of Dr. Parran, and Dr. Parran replied. A private luncheon was given to Dr. Parran by the British Medical Association, at which Dr. J. E. Gordon, United States Liaison Officer with the Ministry of Health, Dr. John R. Mote, Medical Adviser to the American Red Cross Committee in London, Sir Wilson Jameson, chief medical officer to the Ministry of Health, and the principal officers and officials of the association were present.

The *Experiment Station Record* reports that the *Progressive Farmer's* annual award "to the man of the year" for the most outstanding service to the agricultural program in national planning, teaching, research or organization" has been made to Dr. H. P. Stuckey, director of the Agricultural Experiment Station of the University of Georgia. The official statement reads: As a result of Dr. Stuckey's "special work in the thirty-two years at the Georgia Experi-

ment Station we can list 12 superior varieties of muscadine grapes, the cabbage-collard, the now common practice of planting pollinizers in pecan groves, proof that blossom-end rot of tomatoes is due to irregular water supply. Under his supervision and friendly encouragement as director there have been developed the high-yielding Gasta and Sanford wheats, Terruf oats, Doxi soybeans and Cherokee sweet corn. An intensive peanut production research program now producing definite results has been under way since 1931. Dr. Stuckey has played a leading part in the development of the pimiento pepper, in recent years one of the leading cash crops of middle Georgia."

FIFTY scientific men—going back to Aristotle in the past, with Einstein and Millikan representing the present—are shown in a series of three paintings now on view at the New York Museum of Science and Industry, in Rockefeller Center, New York City. They are known as the "Apotheosis of Science," the work of Elmer E. Taftinger, of Indianapolis, executed for Robert Lovell, of that city. Darwin, Pasteur, Harvey, Roentgen and Audubon are among twenty-two scientific men depicted in the left panel. The center panel portrays Aristotle, Hippocrates, Euclid and Archimedes. Einstein appears in the right panel in the company of Newton, Franklin, Faraday, Descartes, Watt, Millikan and fourteen scientific men of both the Renaissance and contemporary periods.

DR. ARTHUR L. WALSH, dean of the faculty of dentistry of McGill University, was elected to the presidency of the American Association of Dental Schools at the recent annual meeting in St. Louis.

At a meeting of the University of Buffalo Chapter of the Sigma Xi on March 17 officers were elected as follows: *President*, Dr. Richard N. Jones, assistant professor of physics, to succeed Dr. Guy E. Youngburg, professor of biological chemistry; *Vice-president*, Dr. Bird R. Stephenson, instructor in biophysics; *Secretary*, Dr. Carleton F. Scofield, associate professor of psychology, and *Treasurer*, Dr. Frederick J. Holl, assistant professor of biology. Seventeen members were elected. Dr. Edward Ellery, national president, spoke on matters of interest to the society. At the initiation meeting on May 9 the annual lecture will be delivered by Professor Stacy R. Guild, of the

Otological Research Institute of the Johns Hopkins University.

RETIREMENTS from active service at the close of the academic year at Columbia University include Dr. Charles E. Lucke, head of the department of mechanical engineering, who has served for thirty-nine years, and Professor Walter I. Slichter, executive head of the department of electrical engineering, who has been connected with the university for thirty-one years.

DR. EDWARD MACK, JR., has been made chairman of the department of chemistry of the Ohio State University to succeed Dr. Wm. Lloyd Evans, who will retire at the close of the academic year.

DR. FRANCIS J. BRACELAND, associate clinical professor of psychiatry at the Woman's Medical College of Philadelphia, has been appointed dean of the School of Medicine of Loyola University, Chicago, to succeed Dr. Louis D. Moorhead, dean since 1918, who has resigned to devote his time to private practice.

DR. DOROTHY S. THOMAS, director of research in social statistics at the Yale University Institute of Human Relations, has been appointed professor of rural sociology in the College of Agriculture of the University of California and rural sociologist of the experiment station and of the Giannini Foundation.

PROFESSOR PETER PRINGSHEIM, formerly of the University of Berlin and the University of Brussels, arrived in the United States in February. He has been appointed lecturer and research associate in physics at the University of California at Berkeley.

DR. JOSEPH E. WECKLER, JR., has been appointed assistant curator in the Division of Ethnology of the U. S. National Museum.

PROFESSOR JOHN GAMBLE KIRKWOOD, associate professor of chemistry at the University of Chicago, has been elected chairman of the division of physical and inorganic chemistry of the American Chemical Society and associate editor of the *Journal of Chemical Physics*.

It is reported in the *News Edition* of the American Chemical Society that Harold G. Petering has resigned as research assistant in chemistry at the Michigan Agricultural Experiment Station, where he has been working on the industrial utilization of agricultural products under the Rackham Endowment Fund. He has become research chemist in the Biological Laboratory of E. I. du Pont de Nemours and Company, New Brunswick, N. J.

PROFESSOR WILBER E. BRADT, head of the department of chemistry and chemical engineering of the University of Maine, has been called to active military

duty for one year as a captain in the 152nd Field Artillery. Dr. Irwin B. Douglass will be acting head of the department.

PROFESSOR QUINCY C. AYRES, of the department of agricultural engineering at Iowa State College, has leave of absence to become lieutenant commander in the Corps of Civil Engineers, Bureau of Yards and Docks.

MISS JOCELYN CRANE, of the department of tropical research of the New York Zoological Society, returned on March 10 from a seven weeks' expedition to Panama. She made a study of the courtship of more than twenty species of *Uca* fiddler crabs, completing observations made on two Zaca trips. She brought back a small collection of live mammals, birds and reptiles for the Zoological Park.

DURING the next two months distinguished leaders in the arts and sciences from Argentina, Brazil, Chile, Colombia and Uruguay will visit the United States for a period of travel and observation lasting from two to three months. Among these are Dr. Josué Gollán, rector and previously dean of the faculty of pharmacy of the Universidad del Litoral in Santa Fé, and Dr. Pacheco e Silva, professor in the psychiatric clinic of the Medical School of the University of São Paulo and the Paulista School of Medicine.

A PARTY which will travel under the auspices of the Carnegie Endowment for International Peace to study agricultural conditions in Brazil, Uruguay and Argentina this spring, will leave New York on April 11. Its members are Dr. T. W. Schultz, head of the department of economics and sociology at Iowa State College; Howard Hill, of Minburn, Iowa; Harry Terrel, of Des Moines, secretary of the Economic Policy Committee; James Patton, of Denver, president of the National Farmers' Union, and J. Elmer Brock, of Kaycee, Wyo., president of the American National Live Stock Association.

The Harvard Alumni Bulletin reports that an emergency expedition of six physicians and five technicians and secretaries has returned to Boston after a month spent in Halifax, Nova Scotia, assisting the medical authorities to combat epidemics of scarlet fever, diphtheria and spinal meningitis in that city. This expedition was headed by Dr. J. Howard Mueller, associate professor of bacteriology and immunology at Harvard University. Associated with him were Drs. LeRoy D. Fothergill, Silas Arnold Houghton, assistant professor of bacteriology and immunology and associate in pediatrics; Emanuel B. Schoenbach, instructor in bacteriology; John H. Dingle, assistant in bacteriology and in medicine; Stafford M. Wheeler, instructor in preventive medicine and epidemiology, and Lewis Thomas, research fellow in medicine. The purpose of the

group was to render assistance to the civilian population of a people at war and to acquire information on communicable disease in a war-time port.

DR. OTTO STRUVE, professor of astronomy at the University of Chicago, director of the Yerkes Observatory and of the McDonald Observatory, gave on March 29 the eleventh Joseph Henry Lecture before the Philosophical Society of Washington. He spoke on "The Constitution of Diffuse Matter in Interstellar Space."

DR. GEORGE R. COWGILL, professor of physiological chemistry at Yale University, lectured at Iowa State College on March 25. The subjects of his lectures were "Nutrition in Tropical America" and "Studies of Vitamin B₂ Deficiency." The former lecture was given at a meeting of Sigma Xi.

THE forty-first annual meeting of the American Association of Pathologists and Bacteriologists will be held at the College of Medicine of New York University on April 10 and 11, under the presidency of Dr. Stanhope Bayne-Jones, of Yale University.

DISCUSSION

ANOTHER NOTE ON THE ISOSTATIC CONTROL OF FLUCTUATIONS OF SEA LEVEL

THE purpose of this note is to supplement an earlier one dealing with the effect of the loading and unloading of the earth's crust by continental glaciers.¹ It discusses very briefly the effect of orogenesis and of erosional degradation upon the level of the ocean. In the absence of accurate data necessary for rigorous discussion and for positive numerical results, certain assumptions are made, the departure of which from the truth is unknown. The writer disclaims, however, any attempt to arrive at numerically reliable results. It is his intention rather to show that sea-level changes with the uplift of mountains and with their degradation, as well as with continental erosion, under the control of isostasy. The problem might be presented in algebraic form without the handicap of numerical assumptions; but there is some advantage in using assumed concrete values and in obtaining even very rough approximations for the measure of fluctuation of sea level. It seems to be more important to sketch a picture of the causes and processes of that fluctuation than to pretend, with defective data, to estimate accurately its amount. The effect on sea level of shift of load in or on the earth's crust is presented from a qualitative rather than a quantitative point of view. The figures used are to be regarded merely as those of an illustrative example.

Effect of orogenesis on sea level.—The great mountain ranges which diversify the surface of the globe have been elevated for the most part since the beginning of Tertiary time. They are sometimes referred to in geological literature as the Tertiary mountains; but some of them were uplifted in post-Tertiary time. The aggregate length of these ranges is about 64,000 km, and their mean width may be assumed to be about 160 km. The altitude of their crests varies greatly. Some of them have suffered degradation throughout a large part of Tertiary time, while others of later uplift have been reduced by erosion relatively little. It is assumed, however, that the "Tertiary" mountains

in general had an initial mean height, in transverse profile, of 3 km. That is to say, the mean altitude of the orogenic belt was increased 3 km, its surface prior to uplift having been that of a lowland; or shallow sea-floor.

The mean initial uplift of the mountains being 3 km in transverse profile, the light rock of which they are composed was depressed 21.75 km into the deeper heavier rock for flotation, according to the equation: $3.3x = 2.9(3 + x)$ where x is the amount of depression. This means that the light rock of the crust (mean density 2.9) was concentrated to a thickness of $3 + 21.75 = 24.75$ km, or 253,440,000 cu. km, in excess of the normal, where no mountains exist. But the 21.75 km of light rock, which was pushed down into the heavy rock, displaced $64,000 \times 160 \times 21.75 = 222,720,000$ cu. km of the latter, and this was distributed in depth to the rest of the earth beyond the mountains; so that the volume of light rock that came into the mountain belts in the orogenic movement exceeded the volume of heavy rock which was displaced and redistributed by $253,440,000 - 222,720,000 = 30,720,000$ cu. km. This lowered the surface of the earth beyond the orogenic belts, sea and land alike, $\frac{30,720,000}{494,080,000} = .062$

km, the denominator being the area of the earth less that of the mountains.

Effect of erosion and sedimentation on sea level.—Let us suppose now that the "Tertiary" mountains have to date lost by erosion the equivalent of a layer 2 km thick over their entire area. This amounts to $64,000 \times 160 \times 2 = 20,480,000$ cu. km. The area of the land surface of the earth is 140,800,000 sq. km. Subtracting from this the area of mountain belts, 10,240,000 sq. km, leaves 130,560,000 sq. km of lowlands that have been degraded at a much slower rate, let us say one fifth of the rate of reduction of the mountains. Then the discharge of sediment to the ocean has been $\frac{130,560,000 \times 2}{5} = 52,224,000$ cu. km from the continental lowland; and the total discharge to the ocean has

¹ SCIENCE, August 23, 1940.

been $20,480,000 + 52,224,000 = 72,704,000$ cu. km. Since the ocean has an area of 363,520,000 sq. km, its floor has received a load equivalent to a layer $\frac{72,704,000}{363,520,000} = .2$ km in mean thickness. This would raise the sea surface, but the load of sediment would depress the sea floor, and consequently the sea surface, and at the same time cause the rise of the continental column by way of compensation. The deposit on the sea floor is reckoned as a layer .2 km thick of density 2.7, and its load would displace in depth a layer of heavy rock $.2 \times \frac{2.7}{3.3} = .1636$ km thick, and so cause a fall of sea level of .1636 km. The net rise of sea level relative to the center of the earth is thus $.2 - .1636 = .0364$ km. The equivalent of the heavy rock displaced in depth beneath the ocean is transferred to the region beneath the continents, but in different proportions to mountains and lowlands. To the mountain belts goes the equivalent of a layer $2 \times \frac{2.7}{3.3} = 1.6363$ km thick of rock of density 3.3; and the mean altitude of the ranges is increased by 1.6363 km, so that, although 2 km has been eroded away, the reduction in mean altitude is only $2 - 1.6363 = .3636$ km with reference to the center of the earth.

To balance the erosional removal of a layer $\frac{2}{5} = .4$ km thick from the lowlands a layer of heavy rock of density 3.3, having a thickness of $.4 \times \frac{2.7}{3.3} = .3272$ km, is supplied to those regions in depth and raises their surface that much. So that, although they have lost by erosion a layer having a mean thickness of .4 km, the reduction of mean altitude is only $.4 - .3272 = .0728$ km, with reference to the center of the earth. It thus appears that, with reference to the center of the earth, the sea level has risen .0364 km, while the surface of the mountain belts has been reduced in mean altitude .3636 km. That is, the distance apart, measured on the earth's radius, of the sea surface and the mean surface of the mountain belts has diminished by $.0364 + .3636 = .4$ km. To one who believes the earth is so strong as to be incapable of yielding, except elastically, to stresses caused by shift of load, this can only mean that sea level has risen .4 km. Similarly, the distance apart of the sea surface and the mean surface of the lowlands has diminished by $.0364 + .0728 = .1092$ km, and the apparent rise of sea level is .1 km. That is to say, on the theory of a perfectly strong earth, the surface of the sea would appear to have risen four times more in one place than in another.

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THE POSSIBILITIES OF SYSTEMIC INFECTION WITH DERMATITIS-PRODUCING SCHISTOSOMES¹

FREQUENT inquiry has been made as to whether the "swimmer's itch" or dermatitis-producing schistosome cercariae of the United States continue their development and set up a systemic infection in man. Brackett² has discussed the "mass of evidence which almost surely indicates that such a thing does not happen." A portion of the evidence discussed evolves from the fact that nowhere, not even in the regions most severely afflicted with "swimmer's itch," have there appeared systemic infections resembling schistosomiasis following the dermatitis.

In order to obtain information concerning the suitability of primates as hosts of *Schistosomatium douthitti* (Cort, 1914), Brackett exposed the extremities and face of a young female rhesus monkey to the penetration of the cercariae and noted a very mild dermatitis on the exposed areas. Three weeks after the last exposure the animal was autopsied, but no trace of a schistosome infection was seen. Brackett's assumption was that if *S. douthitti*, which develops readily in a wide variety of laboratory mammals, developed readily in man, it would probably have been found in the one monkey used.

Believing the cercaria of *S. douthitti* to be the most likely one of the dermatitis-producing forms to continue development in man, the author exposed a healthy young rhesus monkey to cercarial baths over a period of two weeks' time during the fall of 1939. The exposures were light, and a mild dermatitis was produced after each exposure. The monkey was autopsied four weeks after the last exposure and after a complete and careful examination was found negative for schistosomes. In June, 1940, a second healthy young rhesus monkey was placed for one hour in a 10-gallon metal milk can with the 24-hour cercarial output of 28 snails. The number of cercariae used was estimated to be approximately 28,000. The monkey showed signs of distress and did considerable scratching from shortly after time of exposure until time of autopsy five and one-half days later. A marked dermatitis was evident but mild, considering the number of cercariae that must have penetrated the skin. On autopsy the migrating worms were found to be abundant in the lungs and slight hemorrhage was noted. A third rhesus monkey with a latent case of malaria, estimated to be about three years old, was exposed to *S. douthitti* by having a bottle containing about 400 cercariae inverted on the abdomen. A mild dermatitis was observed the next day, but this rapidly disappeared. Whether the

¹ Aided by a grant from the American Academy of Arts and Sciences.

² S. Brackett, *Am. Jour. Hyg.*, 31: 49-63, 1940.

worms continued their development was not ascertained, as an autopsy could not be conducted on this animal. In all cases, the *S. douthitti* cercariae used were taken from *Stagnicola reflexa* (Say) collected in a pond near Edina, Minnesota.

Attention should be called to the fact that *Cercaria douthitti*, now shown for the first time to penetrate the skin of a very young primate and migrate through to the lungs, might also go at least this far in man, and particularly in children who swim in infested areas. Whether the worms can go farther than the lungs is not known. That the entrance of this species of larval trematode into the lungs might carry infections mechanically from the outside is of potential importance and in the infested areas where wading or swimming is done, may constitute a public health problem not yet realized.

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A CLOTTING FACTOR IN RABBIT PLASMA

WHILE working on the isolation of certain fractions of immune rabbit plasma a fraction that exhibits very high clotting capacity has been found. It was noted that this clotting factor in rabbit plasma is almost quantitatively localized in a very small fraction, namely, that which is precipitated by 20 to 30 per cent. ammonium sulfate (between 200 and 300 gm of dry ammonium sulfate per one liter of plasma). Furthermore, the clotting factor could be isolated in purer form from the mixture of inert proteins precipitable in the above-mentioned concentration of ammonium sulfate. Such separation was possible because the globulin fraction possessing this clotting property is insoluble at pH 5.3 in the absence of NaCl and passes in solution on addition of 0.1 per cent. of NaCl.

The clotting globulin of rabbit plasma prepared in this way is able to accelerate the clotting of freshly shed blood and to clot blood-plasma (prepared by addition of sodium citrate, potassium oxalate, heparin and germanin). Excess of these anti-coagulants did not prevent the clotting of the plasmas by this fraction. Human, horse and rabbit blood-plasmas were used.

The above-described preparation of clotting globulin possessed a high potency. Some of the preparations, when concentrated to contain 10 per cent. total solids, clotted 100 volumes of horse plasma within 30 seconds

and 1,000 volumes in from 10 to 15 minutes. Our experiences so far have indicated that solutions of clotting globulin are comparatively stable. Some preparations of clotting globulin preserved with ether-phenol and phenyl mercuric acetate showed partial loss of potency after one year of storage in the ice box. The described properties of the clotting globulin prepared from rabbit serum suggest the possibility of its use as a hemostatic agent. Work in this direction is in progress.

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LITTLE KNOWN ENEMIES OF YOUNG OYSTERS

It is well known that starfish and drills kill and devour large numbers of recently set oysters. Few persons are aware, however, of the fact that several other species of our common mollusks besides the drills are also inflicting extremely heavy losses among young oysters. Observations carried on during the last four summers showed definitely that two genera of mollusks, namely, *Anomia* and *Crepidula*, are responsible for the destruction of oyster spat in several areas of Long Island Sound, where at the beginning of each season very good set of oysters was recorded.

As a rule, setting of oysters, *Anomia* and *Crepidula*, occurs at approximately the same time. However, the rate of growth of oysters is much slower than that of *Anomia* or *Crepidula*. Therefore, the latter soon outgrow the oysters. While growing, the shells of *Anomia* spread over the oyster spat attached nearby. The oyster spat covered in this manner soon suffocate and die. Our examination of shells collected from the lots where sets of *Anomia* and oysters occurred revealed that in almost every instance there were several smothered young oysters under each *Anomia* shell. In one instance, for example, there were 22 dead oyster spat found under a single *Anomia* five eighths of an inch in diameter. *Crepidula*, although having but one shell, destroys the oyster spat in the same manner. Rapidly growing, it covers oyster spat, which soon dies on being deprived of oxygen and food.

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SCIENTIFIC BOOKS

ENTOMOLOGY

Entomophagous Insects. By CURTIS P. CLAUSEN. 688 pp., 257 figs. New York: McGraw-Hill Book Co. 1940. \$7.00.

THE raw facts in the struggle for existence among organisms are nowhere better illustrated than by the diverse hordes of animals that form the class Insecta. Led by inexorable instincts and provided with innum-

erable "gadgets" in the way of exquisitely adaptive bodily structures, the insects have developed an unbelievably intricate ecological structure which involves practically the whole of their living environment.

This book deals with the most spectacular types of insect behavior, which are those associated with predatism and parasitism, particularly the latter. Both of these are concerned mainly with the insects themselves, since the hosts and prey are most generally other insects; nevertheless these phenomena have their reverberations among other diverse organisms, including man himself, so that they become of great human concern. As a consequence of the latter, one of the major developments of entomology during the past half-century has been the investigation of predatism and parasitism in their varied aspects, not primarily as problems of intense biological interest, but as a necessary prelude to their practical application in furthering the "natural" or "biological" control of noxious insects whose freedom and pursuit of happiness clashes with our own feeble attempts in that direction.

In "Entomophagous Insects" Dr. Clausen presents a brief account (of over 600 pages) summarizing our present knowledge of these insect predators and parasites. He is well fitted for the task, having made extensive contributions on insect parasites over the course of many years and having more recently been entrusted with the management of the work on extensive parasite introduction maintained by our Federal Government.

The material is presented in systematic sequence among the several orders beginning with the Hymenoptera which occupy about half of the book. The Diptera follow, including about 150 pages and the several remaining orders of minor importance are relegated to the last hundred pages. Much more space is devoted to the forms which are parasitic or parasitoidal and justly so, since their behavior is much more varied and complex.

Particularly valuable are the figures and descriptions of the many peculiarly modified types of larvae known among the parasitic Hymenoptera and the accounts of remarkable methods of oviposition whereby the larvae reach their hosts in unexpected fashion.

Altogether the book is highly accurate despite the vast amount of information that has been included. It will be most useful to professional entomologists, but students of more general biological topics will find a discussion of many matters of importance to them from the standpoint of evolution, adaptation, parasitism, speciation, etc. One feature that mars the otherwise excellent printing of the text is the almost complete omission of accents and umlaut marks in the citation of French and German publications.

The complaint is frequently voiced that the principal contributions of entomologists to the progress of science result from their ability to attach names to the insects their colleagues have chosen as materials for biological investigations. Clausen's book, with its extensive and diversified bibliography, will help to dispel this notion, and to indicate the vast opportunities open to students of insect parasitism.

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ANTHROPOLOGY

A Bibliography of Human Morphology, 1914-1939.

By W. M. KROGMAN. 385 pp., sm. 4to, phototype. Chicago: University of Chicago Press, 1941. \$3.00.

ONE of the foremost necessities to every modern branch of science is an exhaustive reliable bibliography; but the compilation of such is one of the most difficult, laborious and ungrateful of tasks, and that particularly in a field which involves so much as does physical anthropology, for that is really the field that Dr. Krogman's present contribution endeavors to cover.

Due to the amount of work involved the compilation had to be limited to publications between 1914 and 1939, which is very regrettable. An even more serious disadvantage was the necessity of limitation of the literature to that of several of the most used European languages, leaving out all the Slavic, besides others. The reason for beginning with 1914 was the publication in that year of the bibliography included in the Martin's text-book of anthropology, though that bibliography is not exhaustive, not generally available, and difficult to use except by an expert.

But to have done all that would have been desirable would have taken a whole staff of workers, years of time and much expense. Dr. Krogman has done what was possible for him, presents a bibliography both well organized and indexed, and deserves the thanks of all workers in this line.

There remains nevertheless with publications of this nature, however excellent and comprehensive they might be, the disadvantage of their being bound in a volume. Even before this is out of the printer's hands there is need of additions, which with a volume are impossible; and there is also no possibility, without much copying, of any regrouping. The only effective remedy for these and all other ills of such compilations would be their future publishing in card form. The ideal would of course be briefly annotated cards such as those being issued by the Wistar Institute.

A. HRDLIČKA

U. S. NATIONAL MUSEUM

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

AFFILIATED ACADEMIES OF SCIENCE

THE American Association for the Advancement of Science fulfills its function as an integrating agency in science to a large extent through its affiliated and associated societies. At present there are 179 of these societies, the total membership of which, including duplicates, is nearly 1,000,000. Such organizations as the American Medical Association and the National Education Association have very large numbers of members.

Among the affiliated societies, the academies of science constitute a special class. As a rule their interests include all the natural sciences, and consequently they serve also as integrating agencies in their respective territories, which are usually states. For this reason the association extends to the affiliated academies every possible assistance, including allowances for the aid of research, the amounts depending on the numbers of their members who are also members of the association. In many cases the association can more effectively advance science through its affiliated academies than directly.

The membership of an academy of science is at least a rough measure of the scientific activity in its territory, for it draws its members from the colleges, secondary schools, industrial laboratories and amateurs. In turn the academy not only affects the science in the educational institutions in its territory, but it influences the scientific activities of state and local governments, and often plays important rôles in problems of utilization and conservation of natural resources and in problems of public health.

Certain statistics for the 33 academies affiliated with the association will now be presented. These statistics should not be given undue weight because the conditions under which the academies operate vary to an appreciable degree; yet they are indicative of the scientific activities in the territories to which they pertain. Another item of significance is the percentage of the members of an academy who are members of the association. Naturally the membership of an academy depends upon the total population of

the territory from which it is drawn. In order to reduce the membership figures to a comparable basis in respect to population, the number of members per 100,000 of total population are presented. It will be seen from Table 1 that the variations in the numbers

TABLE I
MEMBERSHIP OF AFFILIATED ACADEMIES

Academy	(a)	(b)	(c)	(d)	(e)
Alabama	133	293	120.3	10.4	20.1
American Institute ..	...	510	...	...	24.0
British Columbia ..	...	97	...	...	15.3
Colorado-Wyoming ..	238	290	21.8	21.1	30.5
Florida	220	346	57.3	18.2	23.1
Georgia	106	122	15.1	3.9	41.8
Illinois	1,094	1,151	5.2	14.6	31.5
Indiana	888	1,051	18.4	30.7	26.1
Iowa	624	614	- 1.6	24.2	39.4
Kansas	334	611	83.5	34.0	23.5
Kentucky	237	333	40.5	11.7	26.1
Louisiana	186	192	8.1	8.1	20.8
New Orleans	249	297	19.3	60.0	26.3
La. and New Orl.	435	489	12.4	20.7	23.9
Maryland .....	...	38	...	2.1	71.1
Michigan	1,055	1,034	- 2.0	19.7	27.0
Minnesota	409	681	66.5	24.4	32.3
Mississippi .....	...	113	...	5.2	10.6
Missouri	820	752	- 8.3	19.9	22.3
St. Louis	118	409	246.6	50.1	25.2
Mo. and St. L.	938	1,161	23.8	25.2	23.3
Nebraska	198	287	44.9	21.8	31.4
New Hampshire	145	212	46.2	43.1	25.0
North Carolina	223	335	50.2	9.4	41.2
North Dakota .....	...	...	...	...	...
N. W. Sci. Assn. ....	...	528	...	...	15.7
Ohio	462	678	46.7	9.8	51.2
Oklahoma	365	313	- 14.2	13.4	25.9
Pennsylvania	452	424	- 6.2	42.8	39.9
South Carolina	225	187	- 16.9	9.8	27.3
Tennessee	349	418	19.8	14.3	26.3
Texas	475	651	37.1	10.1	30.9
Virginia	686	855	24.6	31.9	25.4
West Virginia	254	305	20.1	16.0	23.0
Wisconsin	375	322	- 14.1	10.3	55.7

(a) Number of members in 1936 as reported by the secretaries of the academies.

(b) Number of members in 1940 as reported by the secretaries of the academies.

(c) Percentage change.

(d) Members in 1940 per 100,000 population of state or area.

(e) Percentage of members in 1940 who are members of the Association.

of members relative to populations are very large. Likewise the rates at which the memberships of the academies changed in the interval 1936-1940 have varied widely.

F. R. MOULTON,
Permanent Secretary

SPECIAL ARTICLES

A CASEIN DIGEST BY VEIN UTILIZED TO FORM BLOOD PLASMA PROTEIN¹

To be able to feed an individual by other than the oral route has been the desire of investigators and medical men for many years. Many patients could be benefited and many experiments could be performed

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if such a technique were available. One difficulty has been the parenteral administration of the protein requirements. Henriques and Anderson² achieved first success with an enzymatic digest of meat. Holman, Mahoney and Whipple³ found that the protein of

² V. Henriques and A. C. Anderson, *Zeit. f. Physiol. Chem.*, 88: 357, 1913.

³ R. L. Holman, E. B. Mahoney and G. H. Whipple, *Jour. Exp. Med.*, 59: 269, 1934.

whole plasma can supply the body protein needs. Plasma is now widely used for the treatment of shock, but its use for nutritional purposes is restricted by its relatively limited supply. Protein digests should fill this need and supplement all plasma protein treatment. Casein digests intravenously have been used with some success by Elman⁴ as well as by others. Digests have been effective subcutaneously.⁵

By established technique⁶ for the measurement of plasma protein production in hypoproteinemic dogs, we have determined that an enzymatic (papain) digest of commercial casein⁷ given parenterally is as effective in plasma protein production as whole liver by mouth. This digest provides materials needed to correct the hypoproteinemia as well as nitrogen for other body protein requirements.

TABLE 1
CASEIN DIGEST BY VEIN
PROMOTES PLASMA PROTEIN PRODUCTION

Diet per period*		Plasma protein removed, total	Plasma protein level, average	Urine N, total
		gm.	gm. per cent.	gm.
Dog 39-223				
	Initial	25.4	5.92	12.6
1	Fasting	14.9	5.44	4.9
2	Low protein	20.9	4.12	8.8
3	Liver	21.9	3.95	8.3
4	Liver	21.0	4.07	7.8
5	Liver	21.0	4.12	7.4
6	Liver	19.4	4.04	10.2
7	Digest	17.4	3.93	10.4
8	Digest	22.8	4.27	11.1
9	Digest	18.6	3.98	9.9
10	Digest	3.4	4.54	9.4
11	Digest	3.3	5.08	9.5
12	Digest	1.6	5.18	9.6
13	Digest	1.7	5.29	10.1
14	Digest	3.3	5.56	9.9
15	Digest	1.8	5.59	9.4
16	Digest	23.5	4.54	9.7
17	Digest	17.6	4.07	10.0
18	Digest	12.9	4.04	9.2
Dog 39-316				
6	Digest	15.6	4.04	13.0
7	Low protein	1.5	4.36	7.1
8	Digest†	1.5	4.59	12.8
9	Digest†	2.9	5.42	18.1

* Data are for consecutive 7-day periods.

† Given subcutaneously.

The dried digest is a golden yellow granular material containing 12.5 per cent. nitrogen. In a 5 per cent. solution, sterilized by Seitz (EK) filtration, it is well tolerated when given either intravenously or subcutaneously. While salivation is common during injection and vomiting sometimes occurs with the relatively rapid rate of injection used, no reaction even mildly serious has ever appeared. In fact, during all but the

last two weeks of the 13-week interval in which dog 39-223 (Table 1) received daily 12 gm of the digest by vein, the dog also ate completely a diet containing carbohydrate and fat (80 calories per kilogram), minerals and vitamins, free of protein except for that present in the yeast, and liver vitamin supplements (2.2 gm daily). During periods 18 and 19, Table 1, the diet was 70 per cent. consumed.

A portion of the data obtained from our experiments is given in Table 1. The protein removed by plasmapheresis during the first 2 periods (40.3 gm) comes partly from reduction of the plasma protein level but largely from surplus extravascular tissue protein present in the body at the start of the experiment. The constancy of the plasma protein output (21 gm) and of the plasma protein level ($4 \pm$ gm per cent.) of periods 3 through 6 indicates a direct relationship between the protein consumed (70 gm per week, in liver) and that produced. A similar relationship obtains during periods 7 through 10 when the casein digest equivalent to 66 gm protein replaced the liver, with an average plasma protein production of $19 \pm$ gm per week. Cysteine and tryptophane added during period 7 apparently do not improve this digest.

With discontinuance of plasmapheresis during periods 11 through 16 a prompt rise in plasma protein concentration occurred and then progressed more slowly to a peak of 5.70 in period 16. Redepletion was accomplished in period 17. Despite some lack of appetite for the oral low protein diet in periods 18 and 19 the plasma protein production is similar to that of the earlier periods. The dog was in positive nitrogen balance while receiving the digest and gained in weight from 8.5 to 9.3 kg. The 20 per cent. increase in urinary nitrogen excretion over that of the liver diet periods occurred in other than the urea and ammonia fraction.

The data obtained in dog 39-316 indicate effective utilization when the digest is given under the skin. Digest equivalent to 82 gm protein was given by vein in period 6 and subcutaneously in period 8, then increased to 138 gm in period 9. Nitrogen balance was positive in all 3 of these periods. A steady rise in the plasma protein level is noted in the absence of bleeding.

These and other observations, to be published later in more detail, show clearly that certain *digests* given by vein or subcutaneously *promote new plasma protein production* as effectively as protein fed by mouth. This holds great promise in clinical therapy.

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⁴ R. Elman, *Ann. Surg.*, 112: 594, 1940.

⁵ S. S. Altshuler, H. M. Hensel and M. Sahyun, *Am. Jour. Med. Sci.*, 200: 239, 1940.

⁶ For references see S. C. Madden and G. H. Whipple, *Physiol. Rev.*, 20: 194, 1940.

⁷ This casein digest was prepared by the Eli Lilly Company.

REDUCTION IN THE BLOOD PRESSURES OF RENAL HYPERTENSIVE DOGS WITH HOG RENIN¹

A NUMBER of attempts to reduce the blood pressure of renal ischemic hypertensive dogs have been reported recently. Most of these have been unsuccessful, although a few investigators have obtained results showing some promise. Several months ago we reported the production of an antiserum for renin and stated that we purposed to determine the value of "antirenin" actively produced in the therapy of experimental renal hypertension.² At this time therefore preliminary results obtained by the treatment of hypertensive dogs with hog renin are presented.

Four dogs rendered hypertensive by the Goldblatt technique were treated for four months with daily intramuscular injections of hog renin representing 1 gram of kidney equivalent per Kg of body weight. Blood serums were examined for antirenin before treatment and subsequently at two-week intervals by a technique previously described.²

The history of the first dog is typical of the striking reductions in blood pressure observed in the four animals.

This hypertensive dog showed an average femoral blood pressure of 164 mm of Hg with a maximum of 184 mm and a minimum of 146 mm, during the three months preceding treatment. The blood pressure of the animal fell more or less steadily throughout the period of hog renin injections until the normal or prehypertensive range was reached in the fourth month of treatment. During the two months following renin therapy, the blood pressure dropped to an average of 114 mm of Hg or somewhat below the original normotensive level. In the succeeding five months the pressure slowly increased, so that it has now reached the pretreatment hypertensive range.

At no time during treatment or subsequently was there any evidence of untoward effects. The appetites of the four dogs remained excellent, their weights constant and their blood urea nitrogens and urinalyses normal throughout the periods of observation.

Typical of the four dogs, antirenin to hog and dog renin was demonstrable in the serum of the dog cited above by the end of the first month of treatment and in the third month reached a maximum which was maintained with fluctuations during the observation period of seven months following therapy.

Probably the mechanism of these reductions in blood pressure involves an immune (antihormone?) response to the heterologous hog renin, inasmuch as dog renin and heat-inactivated hog renin were shown to be without effect on the blood pressure of other renal hypertensive dogs. However, the failure of the antirenin titres (especially to dog renin) to fall as

¹ This work was aided by a grant from the Graduate School Research Fund of the University of Illinois.

² C. A. Johnson and G. E. Wakerlin, *Proc. Soc. Exp. Biol. Med.*, 44: 277, 1940.

the blood pressures of the four dogs increased during the months following renin treatment is difficult to explain on this basis. Conceivably the immune response may be due to some other heat labile constituent of the renal cortex present in the hog renin solution.

Without much question the antihypertensive action of the hog renin injections was not due to the coincidental presence of the antipressor substance under investigation by Harrison and coworkers³ and by Page and associates.⁴ Thus the amounts of kidney equivalent used by them were much larger than those employed by us, the blood pressure increases following cessation of therapy were more prompt in their animals than in ours, and frequently signs of toxicity accompanied their reductions in blood pressure. Moreover, Harrison *et al.*⁵ have shown that their principle inhibits the acute pressor effect of renin and that it is extractable from dog kidney and presumably when so obtained effective in the hypertensive dog.

If the promise of our preliminary findings is substantiated by further work now in progress this type of treatment will be studied in essential hypertension in man.

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THE CYANIDE STABLE RESPIRATION OF THE SEA URCHIN EGG

BARRON and Hamburger¹ claim complete inhibition of the respiration of the fertilized sea urchin egg by cyanide. This can not be confirmed by others.^{2,3} The observation,⁴ that the inhibition is complete just after the addition of cyanide, but soon decreases until about 90 minutes after the admixture, when a constant value is reached, explains this discrepancy. Later stages of development behave similarly, though here the inhibition decreases much faster.⁵ Further the cyanide resistant respiration of the sea urchin egg, as in some strains of yeast,⁶ turned out to be dependent on the oxygen pressure. Owing to these facts Lindahl con-

³ A. Grollman, J. R. Williams, Jr., and T. R. Harrison, *Jour. Am. Med. Assn.*, 115: 1169, 1940.

⁴ I. H. Page, O. M. Helmer, K. G. Kohlstaedt, P. J. Fouts and G. F. Kempf, *Proc. Cent. Soc. Clin. Res.*, pp. 8, 1940.

⁵ A. Grollman, J. R. Williams, Jr., and T. R. Harrison, *Jour. Biol. Chem.*, 134: 115, 1940.

¹ *Jour. Biol. Chem.*, 96: 299, 1932.

² J. Runnström, *Acta Zool.*, 9: 445, 1928; *Protoplasma*, 10: 106, 1930; *Biol. Bull.*, 68: 327, 1935.

³ I. Korr, *Jour. Cell. Comp. Physiol.*, 10: 461, 1937.

⁴ *Zeitschr. vergl. Physiol.*, 27: 136, 1939.

⁵ All experiments performed according to Krebs (*Biol. Jour.*, 29: 1920, 1935) to avoid escape of HCN from the medium.

⁶ Tamiya and Kubo, *Acta phytochim.*, 10: 317, 1938.

cludes, that the CN resistant respiration is not a residual part of the normal respiration, but arises under the influence of cyanide. This view is supported by the lower temperature coefficient of the cyanide stable respiration.⁷

RQ of the developing sea urchin egg is known to be about 0.90 (for literature see⁸). Using a modification of the method of Dickens and Simer⁹ my co-worker Ohman¹⁰ recently determined RQ of the 1-2 hour stage as 0.73 ± 0.01 and of the 7-8 hour stage as 0.85 ± 0.01 . With the 3 manometer method of Warburg I find an RQ of the cyanide resistant respiration of 1.22 ± 0.01 and an almost equal value in both the above mentioned stages, which means a considerably higher value than for the normal respiration. This excludes that an oxidation of cyanide to cyanate could be an important factor of the cyanide stable respiration as suggested for yeast by Pett.¹¹

Using a strain of bakers yeast from Rotebro without substrate I have found HCN (0.001 m) to cause an increase of RQ. With rising oxygen pressure the O_2 consumption as well as the CO_2 production rises, the latter more than the former. This proves that CO_2 is not formed by fermentation. An analysis of HCN and NH_3 reveals that a complete oxidation of HCN does not form any considerable part of the cyanide stable respiration. This will probably be the case for sea urchin eggs also. The high RQ of the cyanide stable respiration of the sea urchin egg suggests either a complete oxidation of some substrate with this RQ or an oxidative decarboxilation taking place. The first

substrates of this kind to be considered are glyceric acid and pyruvic acid ($RQ=1.20$). Both these compounds, the latter in the form of cyanhydrin, increase the cyanide resistant respiration of the sea urchin egg as long as it has not reached its maximal value. Once this rate is reached there is no effect at all.

The inhibition of the respiration in the unfertilized sea urchin egg by cyanide is known to be rather small.^{12, 13} In view of the above reported facts, it seems possible that a larger inhibition in the unfertilized egg may be masked by a cyanide resistant respiration. For further investigation the cyanide resistant respiration of the fertilized and unfertilized egg (0.001 Mol KCN) is measured at different oxygen pressures, ranging from 3 to 100 per cent. The function of the dependence on the oxygen pressure is the same in both cases. The CN resistant respiration does not increase at the same rate as the normal respiration at the fertilization and is in the fertilized egg proportionally much smaller than in the unfertilized. It is thus impossible to determine the real inhibition caused by cyanide in the unfertilized sea urchin egg. In 3 per cent. O_2 the inhibition was at least 70 per cent. Under the same O_2 pressure the normal respiration decreased by 3 per cent. A full description of the experiments will appear in *Archiv för Kemi och Mineralogi*, Stockholm.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

SPIRIT BLUE AGAR: A MEDIUM FOR THE DETECTION OF LIPOLYTIC MICROORGANISMS

The detection of lipolytic microorganisms is important in the study of certain types of food spoilage, in taxonomic bacteriology and in other phases of microbiology. In a recent comparative study,¹ it was noted that each of the media which is used conventionally for the detection of lipolytic organisms falls short in one respect or another. Those media in which a dye is employed as the indicator of lipolysis are often quite toxic for certain types of microorganisms; e.g., Turner's Nile blue sulfate technique inhibits the growth of micrococci.^{1, 2} A sensitive differential medium which could be prepared without difficulty,

which would not harm appreciably the growth of the organisms and which would permit indisputable detection of fat-splitting microorganisms would be of value in the study of lipolysis.

A medium of the following composition meets these requirements:

Agar	30.0 gm
Tryptone	10.0 "
Yeast extract	5.0 "
*20 per cent. cottonseed oil emulsion.....	25.0 ml
0.3 per cent. alcoholic solution of Spirit Blue (National Aniline)	50.0 "
Distilled water to make	1000.0 "

* Prepared by grinding thoroughly in a mortar or coloidal mill: 100.0 ml of fresh cottonseed oil, 10.0 gm finely powdered gum arabic and 400.0 ml of warm distilled water. Thorough grinding will result in a smooth, permanent emulsion in which most of the fat globules are less than 10 micra in diameter. Certain samples of cottonseed oil, because of high acidity, are unsatisfactory for use in spirit blue agar; Wesson oil is entirely satisfactory for this purpose.

¹² J. Runnström, *op. cit.*

¹³ I. Korr, *op. cit.*

⁷ I. Korr, *op. cit.*

⁸ *Archiv f. Zool.*, 32 A, N:o 15.

⁹ *Biol. Jour.*, 905, 1930.

¹⁰ *Archiv f. Zool.*, *op. cit.*

¹¹ *Biol. Jour.*, 30: 1438, 1936.

¹ H. F. Long and B. W. Hammer, *Iowa State College Journal of Science*, 11: 343-351, 1937.

² R. H. Turner, *Jour. Inf. Dis.*, 44: 126-133, 1929.

The agar, tryptone and yeast extract are dissolved in approximately 900 ml of distilled water by autoclaving for several minutes. After complete solution of these components, the cottonseed oil emulsion and the previously filtered alcoholic spirit blue solution are added. The mixture is made up to one liter with distilled water and mixed thoroughly. The medium is sterilized by autoclaving for 15 minutes at 15 pounds (121° C.). Either pour-plates or streak-plates may be used. The completed medium should be stored in a refrigerator to minimize oxidative deterioration; refrigerated sterile plates of spirit blue agar will keep for more than two months.

When prepared from fresh cottonseed oil of a low acid number, sterile plates of spirit blue agar are pale lavender in color and of firm consistency. Colonies of lipolytic organisms are recognized by the development of a permanent deep-blue color beneath and surrounding the colony. No comparable change in color has been detected around colonies of any non-lipolytic organism examined.

The growth characteristics and lipolytic activity of more than 200 species of bacteria, yeasts and molds were examined by means of spirit blue agar. In no instance was there observed an inhibition of growth or of lipolysis which might be attributed solely to the dye; particularly significant is the excellent growth of all the Micrococcaceae which were examined. By use of this medium, it is possible to get "total" counts on dairy products, air and sewage which compare favorably with those obtained by the standard quantitative methods for the examination of these products, and, at the same time, the numbers of lipolytic organisms may be determined.

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AN IMPROVED METHOD OF APPLYING COLORED PENCILS

THE procedure described below is so simple and useful that it is difficult to believe that it is not already in widespread use, yet in the course of a varied experience in America and Europe the writer has not previously encountered it. Locally, at least, it is the invention of our Spanish draftsman:

To secure a uniform and smooth distribution of the color applied by any good grade of colored pencil, it is only necessary to rub the surface to which the pencil coloring has been roughly applied, with a bit of cloth soaked in gasoline. The cloth may be wrapped over the end of a toothpick or the blunt end of a penholder for finer work, and simply bunched into a soft mass for larger areas. The procedure is thus identical with the dry rubbing usually employed to obtain a smooth distribution of crayon coloring. The results obtained

by using gasoline compare favorably with a good grade of water-coloring. Much less skill is required to obtain good results, and the work can be done much more rapidly than with paints. Pencil colors so treated are completely fixed, and will not rub off or smudge.

Through the use of gasoline any two pencil colorings may be mixed to obtain a third. Thus, to make a yellow-green, apply first a rough base of yellow, and over it an equally rough surface of green. Upon rubbing with a bit of gasoline-soaked cloth, the two will blend smoothly to produce a yellow-green. Where the colors are of equal value in such mixtures, the color applied uppermost will predominate.

The above technique should be particularly useful to cartographers and others who wish to apply rapid crayon coloring over relatively large surfaces. In the absence of gasoline, turpentine will serve the same purpose, but the oily components of this substance have an adverse effect on lighter grades of paper.

BRANDON H. GROVE

VACUUM OIL COMPANY,
MADRID, SPAIN

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